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FOOD ENGINEERING



COVER STORY

The opportunities for food packaging today are just short of astronomical. On the cover, sheets of steel begin the production of food can containers as waves of plating solution flow over a sheet of steel. Photo courtesy of National Steel, Pittsburgh, PA.

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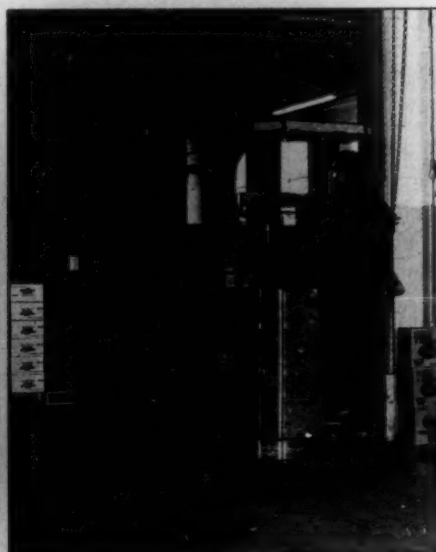
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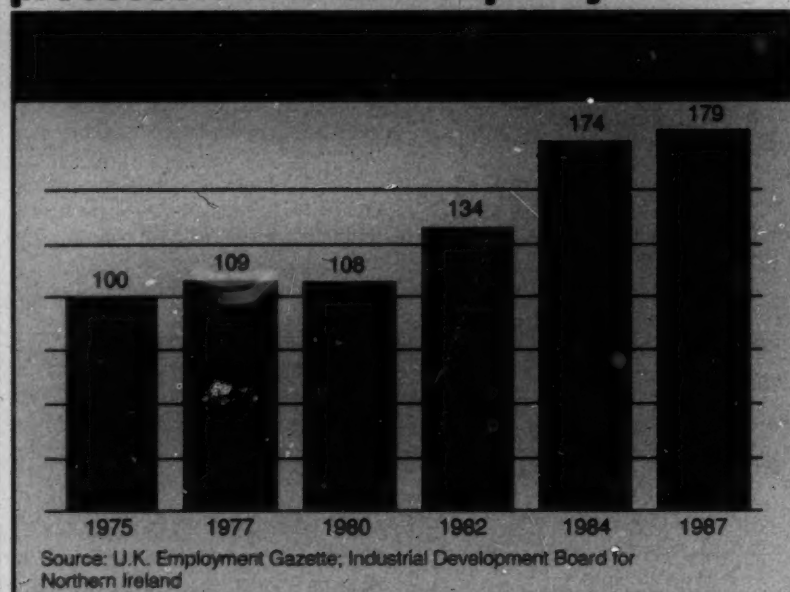
Special Emphasis

FIBER FORMULATIONS

New fiber-added foods are meeting with success in the marketplace.

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Northern Ireland courts U.S. food processors into land of plenty



Northern Ireland's productivity, measured as output per employee per hour, exceeds that of the U.K. at large and is continually improving. (Source: Northern Ireland Industrial Development Board).

Bombings and assassinations are all most Americans ever read about or see on the evening news about Northern Ireland. Yet the murder rate there is one-third the average for all U.S. cities with populations of a quarter-million or more, according to U.S. and U.K. crime statistics. You're five times more likely to get murdered in Detroit, and 4.5 times more likely to get murdered in Washington, D.C. than you are in Northern Ireland.

In spite of the "sectarian" violence afflicting the province, Northern Ireland has a good story to tell as a prospective site for American food processors eyeing the 320 million consumers in the European Common Market, which by 1992 will have eliminated all remaining trade barriers between member nations. The Northern Ireland Industrial Development Board (IDB) has targeted food processing as one of the major industries it wants to attract and is actively courting U.S. food processors to locate plants and/or establish joint ventures in Northern Ireland. According to D. James Gray, industrial-development consul for the Midwest at the British Consulate-General office in Chicago, Northern

Ireland "has the best industrial-relations record and the best productivity record in Europe—although the West Germans might dispute that." Gray sees Northern Ireland as "the gateway to the Common Market" where American marketing savvy can join with European technology and local raw materials to meet consumer demand for convenience foods in Western Europe.

Advantages, incentives

Advantages of Northern Ireland to the U.S. food processor:

- **Location:** Proximity to Western European markets and entree to the Common Market.

- **Raw materials:** Food production, mainly livestock, is Northern Ireland's No. 1 industry. Major products: beef, lamb and milk. 1986 production (farm-gate prices): £281 million of beef and sheepmeat, £196 million of dairy products, £215 million of hogs, poultry, eggs, shell fish, fin-fish, fruits and vegetables—from a province the size of Connecticut. The province prides itself on its disease-free livestock.

- **Labor:** A skilled, well-educated, English-speaking and highly productive labor force with a traditionally

strong work ethic. Productivity in Northern Ireland exceeds that in the rest of the U.K., yet wages are lower. Less than half the labor force is unionized, and unions are "cooperative," says the IDB.

- **Infrastructure:** Utilities—electrical, LPG gas and oil—are all in place, and the province has plenty of fresh water (enough to allow every industrial user 26,000 free gallons per month). "Magnificent" roads make any airport or seaport no more than 2½ hours away. Five commercial seaports with roll-on/roll-off facilities serve world markets, including 150 sailings per week to other U.K. ports. Telecommunications allow direct dialing from any phone to 116 countries. Telex and data-transmission facilities are expanding rapidly.

- **Education and R&D support:** According to Billy Trimble, food industry manager for the IDB, Queen's University (Belfast) offers programs in food chemistry/biochemistry and animal nutrition and offers R&D facilities for irradiation, mass spectrometry, NMR spectrometry and sensory evaluation. The Department of Food & Agricultural Microbiology is involved in R&D projects relating to novel heat treatments for milk, vacuum packaging and controlled-atmosphere packaging, irradiation, genetic engineering, enzymology and rapid microbiological detection methods.

- **Quality of life** includes a mild climate, a pollution-free environment, uncongested roads, "outstanding" schools and recreational facilities.

- **Incentives:** Food processors interested in Northern Ireland need deal with only one agency—the IDB, which offers a wide range of customized incentives. **Capital** incentives include building grants, rent grants, machinery/equipment grants and no property taxes. **Revenue** incentives cover start-up grants, interest-relief grants, training grants, moving allowances for key workers, R&D grants and market-research grants. **Tax** incentives offer tax-relief grants and tax allowances on buildings and equipment. **Financial** incentives include loans and venture capital. For further information, contact: Industrial Development Board for Northern Ireland, IDB House, 64 Chichester Street, Belfast BT1 4JX, or the British Consulate nearest you.

THE PACKAGING BOOM CONTINUES

Packaging technologies continue to make inroads in the food industry. New package designs are being formulated out of several new materials. But there is still a lot of room for the old standbys such as glass and steel.

You can see it anywhere. Glass bottles, paperboard containers, "flexible" packaging, microwave containers, aluminum cans, and plastics. What is it? Food packaging, of course!

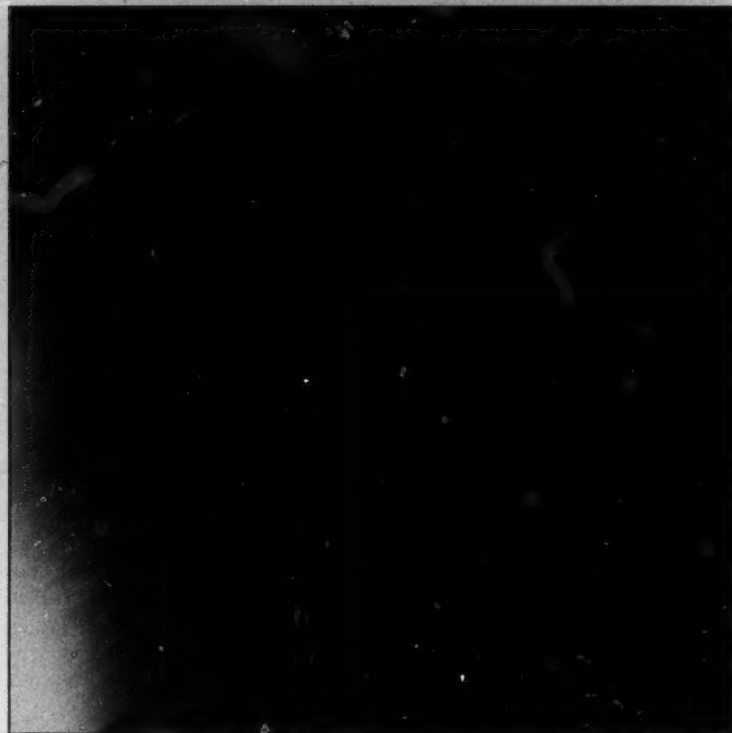
The opportunities for food packaging today are just short of astronomical. The development of containers and packages is so rapid and adaptable that the packaging sector can quickly meet the demands of an industry that is governed by consumers' whimsical tastes and desires.

To see a wealth of opportunities, for example, take a look at some of the significant products that have been developed within the last year or so. Hormel's *Top Shelf* is a shelf-stable, microwaveable entree that needs no refrigeration. *New Traditions*, also marketed by Hormel, is a microwaveable sandwich line—chicken sandwich and bacon cheeseburger. Perdue Foods, Inc. successfully marketed chicken parts using modified atmosphere packaging. And, the most recent development to date, is the successful application of the *Crosscheck* packaging system for Seneca applesauce into individual single serving containers.

Segment forecasts

According to the U.S. Industrial Outlook, published by the U.S. Department of Commerce, every segment of the food packaging industry will show growth throughout 1988. The main categories of rigid containers (metal cans, glass containers, plastic bottles) and sanitary food containers (paperboard, aseptic paperboard food containers, ovenable paperboard trays and containers) will see anywhere from two percent to five percent increases in shipments and usage for the next year.

MARGIE J. RUSSELL
Technical Editor



Specifically, the Department of Commerce reports that product shipments of rigid containers rose 5.4 percent in 1987. In terms of market share, 31 percent of those containers went for soft drinks, 30 percent for other beverages, and 27 percent for food. But the market share by package type remained unchanged from 1986—metal cans, 59 percent; glass, 23 percent; and plastic, 18 percent. For 1988, DOC projects metal can shipments will increase 4.6 percent over 1987, glass containers will be up 2.6 percent, and plastic bottles up 12 percent.

The agency also reports an increase in the value of shipments for sanitary food containers in 1987. This segment showed a two per-

Source: National Steel Corporation, Pittsburgh, PA.

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ICI Americas, Inc. produces its Mellinex line of films from polyester.

cent increase in 1987 and is expected to rise the same in 1988. Sanitary containers accounted for an estimated 13 percent of the constant- and current-dollar value of shipments of all types of paperboard containers.

What's going on

The glass container industry has had its share of ups and downs over the past few years but now it can look forward to "up." Several company consolidations and mergers, the rising prices of plastic and aluminum, and consumer awareness of recycling programs all add up to a projected strong year for glass.

The glass industry has directly helped itself, too, by improving production techniques and introducing new product shapes.

For example, the industry has introduced a 20-ounce nonreturnable bottle for soft drink beverages at about the same cost of producing a 16-ounce bottle. And, best of all, the bottle is recyclable, like all glass.

Since its products are rather easy to recycle, it is no surprise that the glass industry promotes many of the nation's curbside recycling programs. Watchers of the industry took note when Owens-Illinois, Inc., Toledo, OH acquired Brockway, Inc. this year. The glass giants will become one of the largest players in the industry and O-I has always been a leader in promoting recycling programs, which the industry overall has spent more than \$15 million to support.

While the glass industry might be helped by the rising cost of aluminum, it is certain

Designing food packages for recyclability

One of the nation's leading authorities on recycling, Edmond Carreras, says "the largest volume of products going into landfills today is packaging materials. It doesn't have to be this way. Virtually all packaging materials are recyclable."

Carreras heads a national recycling task force organized by the Society of Packaging and Handling Engineers (SPHE). The task force is developing packaging guidelines for use across all industries and is assisting federal, state, and municipal governments in policy-making.

"Aluminum, glass, and paper have successfully been recycled for years," Carreras says. "Today, certain plastics used in food packaging can be recycled into building materials, carpets, and even clothing. The technology exists and is working."

Recycling is now a high-tech industry, says Carreras. "It used to be primarily low-tech and labor intensive," he explains. "It consisted of manually sorting the different materials. However, today food packaging is more complex because it is designed to lengthen shelf life and protect the consumer from tampering."

He cites the example of dry soup mix. Individual portions are packaged in laminated materials—aluminum, plastic, and paper. Four or five layers may be used to protect the product: an

aluminum layer keeps moisture out, plastic adds strength, and paper allows for a printed message. Additional layers are often required between the others to make them adhere. Then the individual packets are inserted in a box. Recycling such composite packaging involves processing multiple types of materials. It is complicated but entirely possible with today's technology.

"We're trying to extend the life cycle of packaging materials," Carreras says. He says a package may have a six-month life cycle in the food industry, then be recycled into a non-food product such as a pallet for another five years, then finally be recycled into a building material for a 30-year life cycle. Recycled plastics are used in such building applications as bathtubs and sinks. A new type of two-inch by four-inch post made of recycled plastics using multiple materials is gaining wide acceptance proving more durable than the standard wooden 2 X 4.

Unlike glass and aluminum, plastic is forbidden by the FDA to be reused as food packaging. The reason is that if the consumer uses a plastic food container to store pesticides, for example, the container will absorb minute but detectable traces of cancer-causing chemicals.

What does all this mean to the food processor? It means that the issues of recyclability and disposability must be

addressed at the very earliest stages of new package design. The designer should satisfactorily be able to answer such questions as: Can this package be recycled? Are the package and material biodegradable? If they are biodegradable, what are the by-products, and are they safe for the environment? Can the package be safely incinerated? Forethought and consideration of the post-consumer phase must be incorporated into the packaging design.

The question legislators and industry are struggling with is "Who is responsible for ensuring that a package can be disposed of or recycled?" Is the package materials supplier responsible? Or the packager?

Some large food companies today are accepting corporate responsibility for the recyclability and disposability of their product packaging. They have made it corporate policy to use only recyclable or biodegradable materials.

"If the material is not recyclable and the food processor does not have a good plan for disposability, legislators will ban the product," he explains. "Government is putting the responsibility on the food processor to use acceptable packaging materials."

"Before making a major investment in new packaging, the food processor must be able to demonstrate how the packaging can be effectively disposed of or recycled," Carreras advises.

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the aluminum can segment is suffering from the price increase. Rising raw material costs have kept profit quite low in the past year for the aluminum can market. However, a new product in the beverage market, the 24-ounce can, has shown acceptance among consumers in some limited test markets.

Manufacturers have introduced aluminum to the packaging industry for other uses besides cans. Take sugar for example: *Montgomery Sugar's Golden Granulated* is packed in a golden aluminum foil bag. Industry sources are also advocating the use of foil trays in microwaves as being completely safe.

Probably the largest growing area right now in packaging is the flexible segment. Some industry sources feel that flexible

packaging—aseptics, retort pouches, dual-ovenable, paper—will eventually replace other packaging alternatives. The reasons for this? There are several: it is cost effective; flexible packaging can replace rigid containers; semi-rigid containers may be developed as alternatives to rigid and flexible containers; and flexible packaging is energy efficient. It takes less energy to make and recycle some forms of flexible packages than it does to make and recycle aluminum.

The most rapidly growing product in the flexible packaging segment is aseptic packaging. Aseptics provide many benefits: no refrigeration, extended shelf-life, convenient to carry, easily disposable. An estimated 5 billion package units were sold in 1987. The most popular aseptic product is fruit juice

"Otherwise, environmentalists and legislators may force the product to be discontinued and the company could lose a great deal of money."

Legislators are formulating laws stating that the food processor has ultimate responsibility, Carreras says. He has a unique vantage point on government activity. His traveling task force is receiving continuous requests to speak to legislative bodies at all levels across the country. They are also providing technical assistance to legislative personnel in developing recycling and disposal policies.

"The food industry has never before had a formal method to effectively plan for recycling and disposability," says Carreras. "The guidelines will show the direction they need to make informed decisions."

Edmund J. Carreras is a principal engineer at the engineering and construction firm of Day & Zimmerman, Inc., Philadelphia, Pa. He is a certified professional packaging engineer and a member of SPPE, the Society of Packaging Engineers, the Technical Advisory Service for Firms, and the American Society for Testing and Materials.

The recycling guidelines being drafted by the SPPE are available from Mr. Kris Mitchell, SPPE Headquarters, Reston International Center, Reston, VA 22091.

The extended life cycle of packaging material



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which sold 2 billion units (U.S. Industrial Outlook).

Steel rises again

Steel in food packaging is enjoying a resurgence. Steel cans are viable packaging options to the industry—when prices of other materials rise, steel drops or remains the same. It is easier to manufacture something out of steel when compared to other packaging materials and the materials can be easily recycled.

Steel also provides its own safety features.

Tamper evident seals are never needed—the steel can provides its own. Steel companies have made an effort to manufacture ultra-clean, light gauge steel cans—the steel is lighter and provides more cans per ton. The end products are cleaner cans for beverages.

Approximately 95 percent of the cans produced for food are steel. In 1987, 28.4 billion were produced but a drop is forecast for 1988 to 28 billion due to the drought and a fire at a major steel facility. A rebound is forecast for 1989, projected to equal the 1987 mark.

The major technology still developing in

Issues to consider in food package development

Food packaging development is a complex task inasmuch as numerous factors must be considered and balanced. First, food and food products with packaging have a long history. The factors are complex and new as developments continue to occur. The food packaging industry is a dynamic one, with a wide range of products, processes and systems available to support the development of new packaging to ensure beyond the ability of food packaging to protect the food product.

Often, price, size and packaging volume have profound influence on the function of a product. However, that is not always evident in the development of the food packaging. The function of the product, packaging and the system of product development are the primary factors. In the food industry, it is typically an integral part of the food product and should be developed as such. Functions that ensure the compatibility and availability of the packaging and product are critical to the success of the product development. The development of the product is a complex activity of many of product development and marketing such as the development of packaging, distribution, and product development. The development of food packaging is a complex activity of many of product development and marketing such as the development of packaging, distribution, and product development.

At first, it is essential to develop a clear understanding of the overall

product concept within the context of the company's corporate mission and objectives. A decision is made whether this product represents a design project or a development project.

As a second step, a multidisciplinary team is formed to ensure that packaging is considered as an integrated system with the food product. The leader is responsible for keeping the focus of the study on the ultimate product while each member's input is studied in detail to ensure that the early identification of potential problems is the critical path to development.

A product blueprint is developed to formalize the focus of the package concept. Sensory and physical attributes which make the product unique or superior to similar products are identified. The production requirements of the food product are listed and considered in the context of the product. The critical production techniques necessary to bring the food. Compliance requirements of the regulatory agencies are factored into the considerations of product-container compatibility. Materials and production systems which are already available are also identified.

After the product blueprint is complete, examples for the packaging are generated. It is especially important that more than one concept be developed as that alternative may be considered. The chance of success greatly improves if a viable alternative, with open avenues to success, is maintained throughout the process.

The influence of new technology is an important factor in the evaluation

of the proposed design. But other factors must also be considered. Potential suppliers should be evaluated on a number of criteria. Their ability to meet the technical specifications of the product must be evaluated. The ability to supply sufficient quantities on a continuing basis. Evaluation of all factors will lead to the selection of critical paths to development of the package. These critical paths will include all factors which may affect time projections.

Given that the choice of packaging can have a major influence on the success of a product, it is critical that the proper choice be made. The appropriate range of options available for food product packaging adds to the complexity of these choices. A systematic approach to product development process at the point that the focus shifts from the quality of the product. Adequately time must be allowed to develop the appropriate development process for the product. The product development process should be developed early and product development should be developed early. The product development process should be developed early and product development should be developed early. The product development process should be developed early and product development should be developed early.

T. Hamilton, P. Evans, M. Miller, E.J. Sisk, R. Wilson, Arthur D. Little Center for Product Development, Cambridge, MA

PACKAGING STATUS REPORT

the steel can segment is the "draw-redraw" can, which is a two-piece can like aluminum. This product is expected to make gains in the soft drink industry. But, the jury is still out on the easy-open steel end can — industry sources do not know if it meets consumers' needs.



Shown are various forms of oriented polypropylene film from Hercules, Inc. The films are used in the snack food market since they provide many barrier properties.

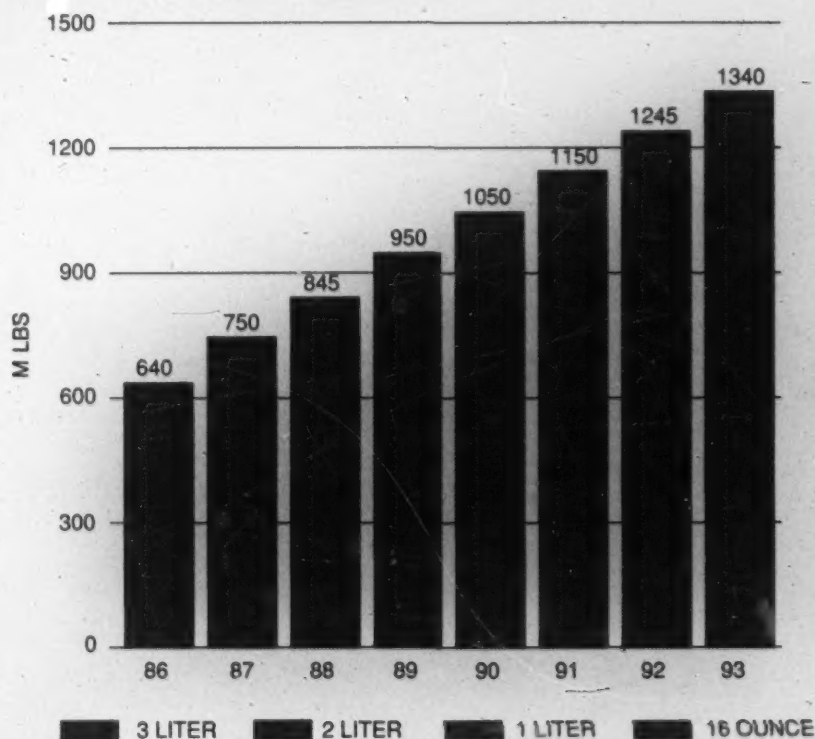
Speaking of plastics

Unless you have been hiding under a rock for the past several years, it is common knowledge that the biggest player in the packaging industry is plastic. Since the advent of plastics in 1970, this versatile material has threatened almost every segment of the industry. There are many advantages to plastic: it is shatterproof, light weight, reclosable, and has clarity.

The most popular polymer in use today is of course PET. Eastman Chemical Products, Inc., Kingsport, TN reports the demand for PET containers in 1987 was 9.5 billion containers for all types of food and general packaging. The estimated total for 1988 is significantly higher at 11.4 billion. The soft drink market is the largest user of PET containers, where 749 million pounds of PET was required for production in 1987, and an estimated 845 million pounds is needed for 1988 production. (See accompanying chart.)

The packaging industry is demanding more plastic but the industry may not get it. For the first time since its introduction, suppliers are facing a shortage of plastic in their

PET consumption (by bottle size)



Source: F.W. Voigt, Jr., Eastman Chemical Products, Inc., Plastics Division, Kingsport, TN

PACKAGING STATUS REPORT

supply lines. Ethylene, the primary raw material used in producing plastics, is in short supply, mainly because of an explosion and fire at Shell Oil Company's refinery in Norco, LA. Shell is a major ethylene producer and the explosion damaged two olefin plants and cut the company's production by about 60 percent. This in turn affected the entire market and caused an increase in prices in an industry that has had traditionally low prices.

Spot shortages may be the only immediate evidence of the decreasing supply. But sources feel that the industry is at a critical point where demand is exceeding supply. Usage and consumption have increased at much faster rates than were ever predicted.

Specialty films

Despite shortages and rising prices, there is probably no greater diversity in film production than that found in the snack food industry. Snack food packaging must unequivocally meet the demands of the product: moisture protection, oxygen and light barrier properties, compatibility with machinery, and ability to provide a good billboard for the product.

A continuing trend in snack film production is one of replacing paper substrates with oriented polypropylene (OPP). Approximately 60-70 percent of the flexible packaging in snacks is OPP which falls into three main markets: clear, metallized, and opaque. In particular, metallized OPP is the fastest growing plastic snack film today, where wide usage is seen in the microwave popcorn segment of the the snack food market.

What's on the horizon?

The packaging industry, even though it has a wide host of opportunities before it, faces some real challenges in the years ahead. It is true that there are more packaging opportunities in this country now than there ever were in the past. However, we are facing a problem of packaging developers who are rushing products into the marketplace before they are really ready for consumer use. Development is being overstated while application is being understated. Machinery manufacturers, film companies, converter companies, and processors must all keep open lines of communication in order to develop the best form of packaging applications.

Another issue which the industry must address in the future is that of waste disposal. The situation appears to be reaching a pinnacle—landfills are reaching their fill points. And even though many materials are

MARKET	1985	1986	1987 ¹	1988 ²
TOTAL	253.5	262.5	274.6	285.8
Food	83.7	88.0	94.2	101.7
Beverages	60.1	59.9	60.2	60.5
Beer	83.8	86.9	89.5	91.3
Liquor	11.9	10.9	11.0	11.1
Wine	14.0	16.8	19.7	21.2

¹Estimated.
²Forecast.

Source: U.S. Department of Commerce: Bureau of the Census and International Trade Administration. Industry sources.

MARKET	1985	1986	1987 ¹	1988 ²
TOTAL	97.9	100.7	105.2	109.7
Beer	35.6	38.0	37.0	38.0
Soft Drinks	34.5	36.8	41.0	44.1
Food	27.8	27.9	27.2	27.6

¹Estimated.
²Forecast.

Source: U.S. Department of Commerce, U.S. Industrial Outlook, 1988.

too expensive to recycle, consumer interest is rising when it comes to recycling packaging materials. A poll conducted by the Gallup Organization, Inc. asked consumers: "What would you do if you knew a certain food or beverage container could not be recycled?" More than half of the respondents, 54 percent, said they would switch to a container that can be recycled, 33 percent said they would not switch, and 12 percent did not know.

Many states are introducing legislation to ban the use of various packaging materials. The strictest ban is planned to go into effect next year in Suffolk County, NY where a total plastic ban has been proposed. As expected, industry organizations are rallying to fight the ban, including the Society of the Plastics Industry, the Flexible Packaging Association, and the Polystyrene Packaging Coalition. As consumers, do we demand more complicated packages or a safer environment? And, can we have both?

Numbers for metal cans and glass containers show steadily growing markets for the next several years.



FORMULATING FIBER INTO FOODS

"Evidence related to the role of dietary factors in cancer [and gastrointestinal diseases] suggests that foods low or reduced in calories and fat and high in fiber should be made increasingly available by food manufacturers."—C. Everett Koop, M.D., Sc.D., Surgeon General

Dietary recommendations to Americans suggesting increased fiber intake are not new. As early as 1982, the National Academy of Sciences (NAS) made the following recommendation: "Eat whole grain cereal products, fruits and vegetables daily." This was followed by a similar recommendation from the American Institute of Cancer Research in 1983.

By 1984 the recommendations specifically mentioned fiber, when the American Cancer Society said, "Eat more high fiber foods such as fruits, vegetables and whole grain cereals." The same year, the National Cancer Institute (NCI) suggested that Americans con-

sume foods which provide 25 to 35 grams of fiber daily.

Despite these recommendation, though, controversy surrounds the role of fiber in the diet. In 1985, the American Council on Science and Health (ACSH) said that while fiber might protect against colon-rectum cancer because it might reduce exposure of intestinal cells to carcinogens by diluting the intestinal contents and by reducing transit time, that dilution can in fact be due to other factors as well.

A brochure published by ACSH, entitled *Diet and Cancer*, stated: "Unfortunately, as attractive as this hypothesis is, the results of

ANN E. PRZYBYLA
Technical Editor

FIBER

Source: ProductScan Marketing Intelligence

It is also not certain what role each component of fiber plays in disease prevention. The executive summary of the report of the Committee on Diet, Nutrition, and Cancer of the National Research Council states: "The committee found no conclusive evidence to indicate that dietary fiber (such as that present in certain fruits, vegetables, grains and cereals) exerts a protective effect against colon-rectum cancer in humans. Both epi-

Lignin, polymer of aromatic plant alcohols, the woody substance that gives plants structure and support. As lignin hardens, it acts as the cement to hold the other plant cell wall constituents together. This structural stiffening helps prevent biochemical degradation and physical destruction of the cells and may account for the effectiveness of wheat bran as a fecal bulking agent.

miological and laboratory reports suggest that if there is such an effect, specific components of fiber, rather than total fiber, are more likely to be responsible."

Some studies have indicated that the water-soluble fiber from foods such as oat bran, beans, or certain fruits are associated with lower blood glucose and blood lipid levels. The Surgeon General's report also addresses this point. It states that while frequent consumption of vegetables and fruits, particularly dark green and deep yellow vegetables and cruciferous vegetables (such as cabbage and broccoli), may lower risk for cancers of the lung and bladder as well as some cancers of the alimentary tract, the specific components in these foods that may have protective effects have not yet been established.

"Dietary patterns emphasizing foods high in complex carbohydrates and fiber are associated with lower rates of diverticulosis and some types of cancer. The association shown in epidemiologic and animal studies between diets high in complex carbohydrates and reduced risk for coronary heart disease and diabetes mellitus is, however, difficult to interpret. The fact that such diets tend also to be lower in energy and fats, especially saturated fat and cholesterol, clearly contributes to this difficulty," states the report.

Increasing fiber content of foods

Despite the uncertainty of fiber's exact role in disease prevention, the recommendation from the Surgeon General is clear—Americans should increase their complex carbohydrates and fiber intake.

Nabisco's Owen observed that while, at one time consumers' perceptions of nutrition was concerned with maintaining a desirable weight, it has been redefined so that now the American public is demanding disease prevention from nutrition.

In addition to following the Surgeon General's advice, food manufacturers have an added incentive for increasing fiber content in their products. It has been reported that in 1985 when Kellogg Company put the message on its All Bran cereal that the NCI recommended that Americans eat a diet higher in fiber, bran cereal sales in general rose more than 30 percent.

The percentage (on a poundage basis) of bran cereal purchased as compared to total cereal sales also increased in 1985. SAMI/Burke Inc., a marketing research firm, reports that 14.7 percent of all cereal sold in 1984 was bran cereal. This figure jumped to 16.6 percent in 1985 and to 17.0 percent in 1986. As consumers began to become more

FIBER SOURCES

Type/Brand Name	% Total Dietary Fiber	Characteristics
GRAINS		
Better Basics™ Oat Fibers	93	Fluffy and flour-like, bland taste and no odor.
Oat bran	18-23	Natural oat flavor and odor.
High Fiber Bits (oat)	30-40	May be flavored or colored to enhance taste and eye appeal.
All bran oat flour	68	Bland color.
Dietary Fiber (corn bran)	90 or greater	Fine particle size, mild aroma, bland flavor and light color.
Sunlite™ Corn Bran	80-85	Comes in two granulation sizes (40-10 and 100-20).
Bestbran™ Light (corn)	90	Almost white.
Bestbran™ 90 Toasted (corn)	90	Comes in light toast (cream), medium toast (tan) and dark toast (brown) varieties.
Malted Grain Fiber MGF-200 (barley, malt, rice & cornstarch)	40	Malt taste.
Bran Fiber (amaranth, barley, corn, oats, rye or wheat)	Varies by product	Fibers from hull, bran or whole grain available.
Barley bran/fiber	60-70	Medium or micro grind.
Corn bran/fiber	75-85	Coarse, medium or micro grind.
Oat fiber	85-95	Medium or micro grind. Bland flavor.
Fiber Add No. 1 (wheat, bran oat fiber, corn bran, apple fiber & wheat germ)	60-70	Full flake or micro grind.
DKF fiber corn bran	90	Course, fine and ultra fine grinds. Toasted or non-toasted.
Diet fiber wheat bran	40-45	Golden brown color. Mild or medium granulation.
SOY:		
Fibrin™ soy fiber	75	Bland and odorless
FI-PRO™ F200 soy fiber	55	Light tan color and bland.
FRUIT:		
Taste Apple Fiber	42.85	Light tan to reddish tan, mild apple flavor.
Apple, black currant and citrus fruit fiber	Varies	White-to-cream color available.
Apple fiber	55-65	Medium or micro grind.

FIBER

Possible Applications	Benefits/Comments	Supplier
Reduced calorie white breads.	High water absorption.	Williamson Fiber Products Louisville, KY Circle 321
Hot and cold cereals.	High ratio soluble fiber to total dietary fiber.	National Oats Company Cedar Rapids, IA Circle 322
Breads, muffins, soft pretzels.	Retains integrity through normal processing.	Custom Industries, Inc. St. Louis, MO Circle 323
Baked products.	—	Niblack Foods Rochester, NY Circle 324
Cereals, breads & rolls, pizza, pasta.	Low fat which help eliminate off-flavor caused by rancidity. Absorbs water. Low caloric content.	Corn Products Unit of CPC International, Inc. Summit-Argo, IL Circle 420
Cereals, bakery products, snacks.	Low caloric content (less than 1/2 calories per gram).	J.R. Short Milling Company Chicago, IL Circle 325
White breads, pasta, cereals.	Low caloric content (1/2 calorie per gram).	A. E. Staley Mfg. Co. Decatur, IL Circle 326
Breakfast cereals, snacks, cookies, bakery toppings.	Can replace part of flour in formulation to reduce calories.	A. E. Staley Mfg. Co. Decatur, IL Circle 326
Bread and rolls, crackers, extruded products, bran muffins.	Excellent water absorption properties — 2 times dry weight.	Coors Bio Tech, Inc. Westminster, CO Circle 329
Bakery products, cereals.	(Manufacturer's note: Hull of grains is not as high in soluble fiber as bran).	Freeman Industries, Inc. Tuckahoe, NY Circle 329
Variety of food products.	Calories per gram .80. Crude fiber 22/25%.	Canadian Harvest St. Thomas, Ontario, Canada Circle 330
Cereals, baked goods, pasta and supplements.	Calories per gram .60. Crude fiber 25%.	Canadian Harvest St. Thomas, Ontario, Canada Circle 330
Baked goods, diet mixes and supplements.	Calories per gram .30. Crude fiber 30/35%.	Canadian Harvest St. Thomas, Ontario, Canada Circle 330
As fiber supplement, drinks.	Calories per gram 1.70. Crude fiber 23%.	Canadian Harvest St. Thomas, Ontario, Canada Circle 330
Cereals, snack foods, variety breads, baked goods, pasta.	Low in calories.	Lauhoff Grain Company Danville, IL Circle 331
Baked goods, snack foods, variety breads, cereals, pizza crusts.	Low in calories.	Lauhoff Grain Company Danville, IL Circle 331
Various types tailored to specific applications.	Primarily cell wall material of soybean — no hull or bran. Has 10% cellulose and 65% hemicellulose and non-cellulosic polysaccharides.	Protein Technologies International St. Louis, MO Circle 332
Dairy products, baked goods.	From defatted soy flakes. High water binding capacity (7x). Soluble fiber content 15-19%.	Grain Processing Corp. Muscatine, IA Circle 333
extruded products.	High in pectin (19%). Soluble fiber 11.13%.	Tastee Apple Inc. Newcomerstown, OH Circle 334
Baked goods.	Citrus products from whole skim and pulp or juice sacs.	Freeman Industries, Inc. Tuckahoe, NY Circle 338
Baked products.	Calories per gram .90. Crude fiber 36/40%.	Canadian Harvest St. Thomas, Ontario, Canada Circle 339

familiar with other sources of fiber, however, sales of bran cereals leveled off, explains Alan B. Miller, Jr., of SAMI. In 1986, the percent of cereal purchased that had bran or fiber in its name was 16.5 percent, and for the year ending July 15, 1988 it was 16.8 percent.

The chart on page 78 shows the variety of new products with added fiber introduced in the first seven months of 1988. Cereals only made up 23.3 percent. And new products with added fiber introduced from January to August 8 of 1988—81—already outnumber those introduced in 1987, according to ProductScan, an on-line new product tracking service from Marketing Intelligence Ltd.

These new fiber-added foods are meeting with success in the marketplace. A study was conducted in May, 1987 concerning acceptance of FI-BAR—a high energy bar with 12 sources of dietary fiber. Of 300 respondents, 64 percent expressed positive purchase intent after trying the bar. The manufacturer, Culver City, CA-based Natural Nectar Corp., reported “phenomenal sales” in initial markets in California and the Northeast.

Last July, Wheat n’ Bran Triscuit Wafers were introduced nationally by Nabisco Brands, Inc., East Hanover, NJ. In making the introduction, Faye Egan, director of the Nabisco Consumer Food Center said, “Consumers definitely want more bran in their diets, but they also want it in products that taste good and can be used at times other than breakfast. This cracker is being introduced in response to those consumer needs.”

Ready-to-eat cereals is estimated to be a \$5 billion market. And the competition for fiber-containing ready-to-eat cereals is especially stiff. Last month, Ralston Purina Company expanded distribution of its Bran News Cereal which had been introduced on the west coast in March. According to the manufacturer, the cereal features cereal that stays crunchy in milk and tastes great, two important qualities many consumers say have been lacking in bran cereals.

Numerous products state: “good source of fiber”; “high-fiber”; “fiber-rich”; etc., on the front panel. These include: Post Fruit & Fibre; Post Grape-nuts Flakes; Ralston Bran Chex; and Ralston Wheat Chex.

Even new foods which don’t actually claim fiber added but contain ingredients associated with fiber are being readily accepted by consumers. Tree Top, Inc., Selah, WA, reports that the first week Tree Top apple bread was on shelves in eastern Washington and Portland, sales were double what was expected. The bread contains real apple pieces and sunflower seeds.

Type/Brand Name	% Total Dietary Fiber	Characteristics
VEGETABLE:		
Nutrio™ P-Fibre 150 (peas)	50	Coarse, medium and fine grind. Natural color.
Dupro™ fiber concentrates (legumes)	50-90	Crisp or pulpy texture. Natural color or bleached.
Pea fibres	N/A	Neutral, white color. Bland flavor.
Tomato fiber	55-65	Medium or micro grind.
Lupran™ (sweet lupin bean)	83-93	Neutral color and taste.
Barley's Best™ bran flour	70	Uniform coarse powder.
Hi-Fi Lite (yellow pea hull)	90	Neutral odor and flavor powder.
MISCELLANEOUS:		
Fibrex™ (sugar beet)	81	Fine through coarse sizes available. Bland flavor.
DuoFiber	80	Bland taste, off-white color.
Sugar beet fiber	60-65	Medium or micro grind.
Totofiber™	55-60	Sl. yellowish gray powder with faint odor and mild, pleasant taste.
GUMS:		
Nutrioid Fiberplus™ (blend of natural gums)	85-95	Free flowing powder, will not affect color of food product.
Gumix natural gums (gum arabic, gum tragacanth, guar gum)	80-90	Bland taste, off-white color.
DYCOL™ 3600 FC guar gum	85-90	Free flowing, moderately coarse powder. Creamy white color.
Gum arabic	80-90	Bland taste, off-white color.
Guar gum	85-90	Bland taste, off-white color.
Carrageenan	80-90	Bland taste, off-white color.
GENU™ carrageenans and pectins	80-90	Pectins: light cream to light tan color. Carrageenan: off-white, bland.
Locust bean gum (and other gums)	80-95	Off-white, bland taste.
Satia™ xanthan gum (and other gums including carrageenan)	80-95	Blend of gums also offered.

FIBER

Possible Applications	Benefits/Comments	Supplier
Supplements, baked products, drinks.	Water binding capacity 12 times its own weight.	Grindsted Products, Inc. Industrial Airport, KS Circle 340
Meat systems, bread, rolls, extruded products.	Equal portions soluble to insoluble fiber.	Durpo Div. Dumas Corp. Golden Valley, MN Circle 341
Breads, crackers, muffins, snacks, frozen and microwave crust products, pet foods, tomato products.	Good water binding capability.	DOS Nutrio Copenhagen, Denmark Circle 342
Processed meats, soups, confections, cookies.	Calories per gram 2.20.	Canadian Harvest St. Thomas, Ontario, Canada Circle 343
Tomato-based products.	Selective breeding used to produce Lupin strain with easy-to-digest protein. Contains 40-50% crude fiber.	Intl. Nutrition & Genetics Corp. Minneapolis, MN Circle 327
Cereals, pancake mixes.	Has 1.35 calorie per gram and 3% soluble fiber.	National Grain Products Co., Inc. Minnetonka, MN Circle 360
Cereals, granola bars, snacks, pasta, nutritional beverages.	Good water holding ability.	Woodstone Foods Minneapolis, MN Circle 361
Bread and other bakery products, pasta, cookies, fiber blends.	High water holding capacity. High pectin content — 25%. Has 20-25% soluble fiber.	Delta Fibre Foods Minneapolis, MN Circle 344
Cakes, breads, rolls, cookies, cereals, pasta, meat products.	Less than 0.55 calories per gram. At least 10-15% soluble fiber.	American Crystal Sugar Co. Moorhead, MN Circle 345
Baked products, cereals, pasta.	Calories per gram 90. High in pectin and soluble gums. Crude fiber 22%.	Canadian Harvest St. Thomas, Ontario, Canada Circle 345
Baked goods.	Absorbs 5 times its volume of water. Contains 2-3% soluble fiber.	Tri-K Industries, Inc. Emerson, NJ Circle 346
Breads, cookies, cereals, ice cream, drinks, snacks, fiber supplements.	At 1.25% use level in instant drink will result in 3.0 gm added fiber per serving.	TIC Gums Belcamp, MD Circle 348
Instant beverages, snacks, baked goods, soups, ice cream, high fiber products (for stabilization).	Provides stabilizing and other functions.	Gumix International, Inc. Hackensack, NJ Circle 349
Cereals, beverages, bakery products.	Hydrates to a medium viscosity in aqueous dispersions.	National Starch and Chemical Corp. Bridgewater, NJ Circle 350
Hot cereals and high fiber mixes.	Low viscosity.	Colloides Naturels Inc. Bridgewater, NJ Circle 351
Drinks, juices.	High viscosity.	Colloides Naturels Inc. Bridgewater, NJ Circle 351
Cheese, sauces, gravies.	Has gelling capability.	Colloides Naturels Inc. Bridgewater, NJ Circle 351
Puddings, custards.	Pectin extracted from citrus peel.	Hercules, Inc. Middletown, NY Circle 353
Beverages, frozen desserts.	Stabilizer.	Hercules, Inc. Middletown, NY Circle 353
Beverages, desserts, sauces.	Stabilizer, thickening agent.	Sanofi Bio Ingredients, Inc. Germantown, WI Circle 354

And product labels are being changed to point out natural sources of fiber such as beans. Campbell Soup Company, Camden, NJ, now includes "Natural High Fiber Source" on its bean products.

The high level of consumer interest in increasing the fiber content of foods can also result in a better image for functional ingredients such as gums. This could be especially beneficial in frozen dairy desserts where gums are used as stabilizers, yet perceived by many consumers as a less than desirable ingredient.

If the public can be educated that gums are a source of fiber rather than thinking them as "additives," there wouldn't be as much resistance to purchasing foods with various gums in the ingredients list, points out Steve Andon, of TIC Gums, Belcamp, MD. The amount of gums used in food formulations is so small, it doesn't contribute significantly to the total fiber content of the foods.

At the same time, fiber is becoming more and more a part of diet food formulation. The success of studies examining fiber's effect on obesity and appetite control is leading to a whole new "fiber" approach to weight control, points out Peter Stewart of Canadian Harvest. "One of the basic ideas of these products is to substitute fiber for other high calorie food ingredients," explains Stewart. "With high fiber foods the fiber's ability to absorb several times its weight in water causes it to gain volume in the stomach, making the dieter feel fuller."

Formulating with fiber

As food manufacturers increase fiber levels of food products, demand is rising for methods to do so while retaining the palatability of these products. Stewart points out that fibers have been developed with improved water activity (absorption); binding properties—of various sugar and carcinogenic molecules; fat absorption; shelf life or stability; time release characteristics; and compressibility (i.e. the blending of a selection of fibers in a proportion to achieve specific calculated results and benefits such as dietary foods for diabetics that are designed to reduce blood sugar levels and flatten the post prandial response curves).

Delta Fiber Foods offers advice on baking with Fibrex (a fiber made from sugar cane which has 81 percent dietary fiber). The company recommended soaking or scalding Fibrex prior to use and preparation, if it is to be used in soft bread and certain soft cakes, where a dough liquid is used. This allows the Fibrex to absorb liquid; resulting in a stabi-

Type/Brand Name	% Total Dietary Fiber	Characteristics
Unipektine™ pectins	95-100	High and low methoxyl available.
Gelcarin™ carrageenan	80-90	Off-white, bland.
CELLULOSE:		
Solka-Floc™ powdered cellulose	99	White flavorless and inert with eight grades available.
Powdered cellulose grade RC 200 (FCC)	99.5	Highly refined, odorless powder.
Microcrystalline cellulose	99	Fine, white, odorless crystalline powder.
Avicel™ cellulose gel	90-95	Bland taste.
<i>SPECIALTY: Agglomerated with maltodextrin for easier blending</i>		
Insta-Fiber™ C (cellulose)	79	Free flowing, dustless.
Insta-Fiber™ S (soy)	36	Free flowing, dustless.
Insta-Fiber™ O (oat)	79.2	Free flowing, dustless.
<i>OTHER: A number of natural foods contain appreciable amounts of fiber, and, although when used as an ingredient, they may not contribute significantly to the total fiber content, they often offer a perceived benefit to consumers.</i>		
Figs	16.99	Paste, concentrate, powder, nugget or fresh forms.
Dehydrated tropical fruits	Varies — under 10	Dices, chunks, granulates and other forms offered.
Raspberries (and other fruits)	2-5	Available as stabilized fruit and fruit pieces.
Craisins™ (dried cranberries)	approx. 8	Red color.
Raisins	6.8	Available in a variety of forms including: midget, regular, golden paste and concentrate.
Almonds	approx. 2.6	Available in a variety of forms.
Hazelnuts	3	Domestic grown larger than European grown.
Pecans	2.3	Available in a variety of forms.
Soynut	N/A	Available salted or unsalted in onion, garlic, cajun or barbecue flavors.
Carob Powders	46.6	Imparts sweet, pleasant taste.

FIBER

Possible Applications	Benefits/Comments	Supplier
Milk desserts, creams, salad dressings.	Stabilizer, gelling agent.	Sanofi Bio-Ingredients, Inc. Germantown, WI Circle 354
Jams, fruit preparations, milk beverages.	Controls ice crystal growth in frozen desserts.	FMC Corp. Marine Colloids Div. Philadelphia, PA Circle 355
Frozen desserts, beverages salad dressings.	Is essentially non-caloric.	James River Corp. Hackensack, NJ Circle 356
Breads, pastries, cereal, sauces, pasta, canned meats, instant drinks, imitation cheese.	Is essentially non-caloric.	Reed Chemical Corp. Pompton Plains, NJ Circle 357
Cereals, pasta, powdered beverages.	Is essentially non-caloric.	Dasco Annadale, NY Circle 358
Cereals, pasta, powdered beverages.	Source of insoluble fiber. Also acts as stabilizer.	FMC Corp. Food and Pharmaceutical Products Div. Philadelphia, PA Circle 352
Non-fat, flavored milk beverages.	Agglomerated with maltodextrin.	Zumbr, Inc. Hayfield, MN Circle 359
Dry mixes (soups, sauces, fortified drinks.)	Agglomerated with maltodextrin.	Zumbr, Inc. Hayfield, MN Circle 359
Dry mixes (soups, sauces, fortified drinks.)	Agglomerated with maltodextrin.	Zumbr, Inc. Hayfield, MN Circle 359
Juice, bread, cereal, cookies, sauces, fruit mixes, confections.	Among highest fiber ratio of any fruits used in food formulations.	California Fig Advisory Board Fresno, CA Circle 335
Cereals, baked products, snacks, confections.	Guava, mango, pineapple, coconut, banana, etc.	Gourmet Club Oakland, NJ Circle 336
Ice cream, yogurt, baked goods.	—	Kraus & Co. Inc. Oak Park, MI Circle 362
Baked products, cereal, cookies.	—	Ocean Spray Cranberries, Inc. Plymouth, MA Circle 363
Cereals, confections, cookies, fillings, yogurt.	Crude fiber 1.3%.	California Raisin Advisory Board San Francisco, CA Circle 364
Cereals, confections, cookies, snack mixes.	—	California Almond Growers Exchange Sacramento, CA Circle 365
Cereals, baked goods.	Used in Kellogg's Mueslix Five Grain Cereal.	Hazelnut Marketing Board Tigard, OR Circle 366
Cereals, baked goods.	—	Tracy-Luckey Mariem, GA Circle 367
Mixes, granola, natural cookies.	Soynut butter has 3.9% dietary fiber.	Inari Ltd. Mason, MI Circle 368
Sweet baked goods, syrups, ice cream, drinks.	Can replace 25-50% cocoa powders in bakery, dairy and confectionery products.	Spring Tree Corporation Brattleboro, VT Circle 347

FIBER

Top: Food processors are capitalizing on consumers' concern over obtaining an adequate fiber intake by expanding the number of new foods containing fiber. Bottom: A comparison of dietary fiber in a variety of foods is shown.

lized mix. If Fibrex is added to the flour mix, the quantity of liquid given in the formula should be increased.

When Fibrex is used to replace approximately 10 percent of the dough weight the formula needs to be adjusted. The can be done by: replacing a part of the flour with Fibrex; replacing a part of the coarse flour with wheat flour; increasing the yeast content; and adding more dough liquid.

When a homogenous and very compact end product is desired, a finely ground frac-

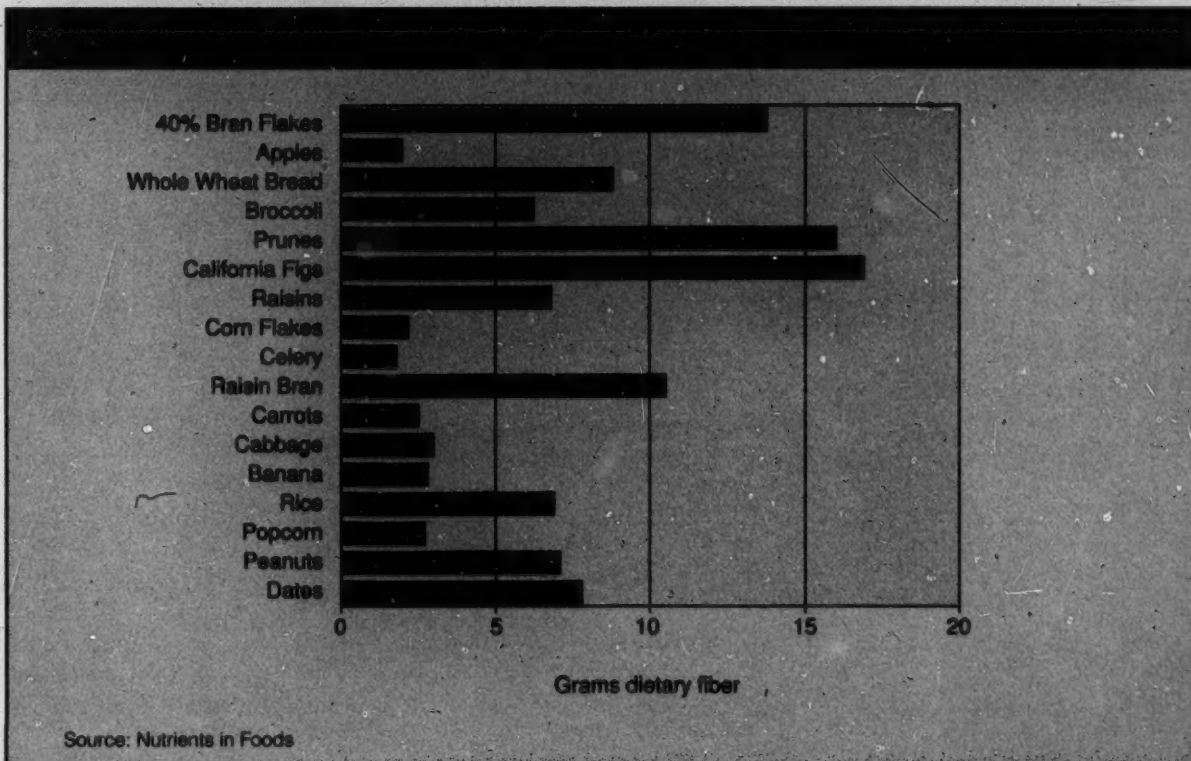
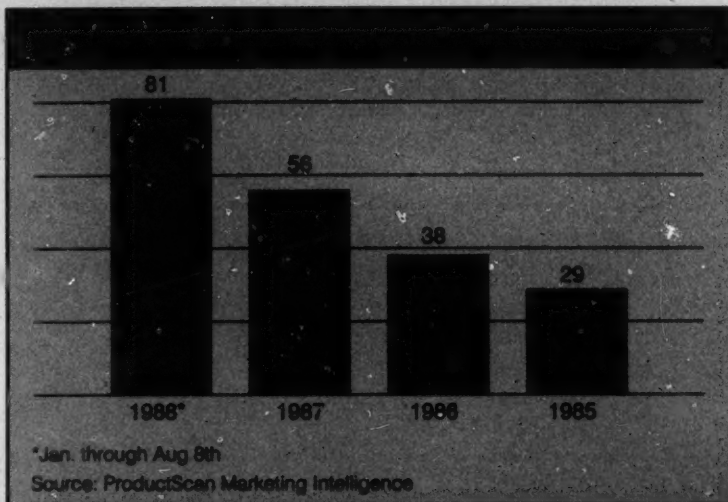
tion of Fibrex (600) should be used. The non-ground fraction (Fibrex 620) should be chosen if a more porous end product is required. The different fractions can also be blended.

It is important to remember that Fibrex does not have the ability to bind a dough together; it only binds together with water.

Bright future for fiber

The average North American consumes 10-15 grams of fiber per day, while the recommendations for fiber consumption are 35-40 grams (another ounce) per day. The potential that this creates is described by Canadian Harvest's Stewart. "One ounce times 365 days times 300 million people in North America translates to 6.8 billion pounds per year in new fiber demand," says Stewart.

But while fiber will be a growing market, a new study entitled, *Dietary Fiber Supplements in North America: Challenges and Opportunities for an Emerging Industry*, by HRA, Inc., Prairie Village, KS, points out that there are going to be niches. "The real key to success for a fiber producer is knowing where the niches are that meet both his product and service strengths," says J.M. (Matt) Hesser, director of HRA. He points out that some of the early traditional grain sources of fiber are being challenged. The individual application is the key and the result is that there is no one ideal source.



PACKAGING BUYERS SURVEY

PACKAGING BUYERS SURVEY

As packaging technologies expand, so do the desires of the users of those technologies. And the challenge for better technology has been issued to suppliers of packaging material and equipment.



Once again the gauntlet has been dropped, and the challenge issued to the suppliers of packaging materials and equipment.

In responding to the questions in *Food Engineering's* annual Packaging Buyers Survey, the members of the magazine's ex-

clusive Executive Advisory Panel are letting the packaging companies know, "You've done well...but there's a lot more to be done." The solutions to yesterday's problems provide the basis for today's technological advances; but the challenge is never-ending.

LINDA K. FREEMAN
Contributing Editor

Machinery purchases

Respondents were asked to check the types of packaging machinery their operation had purchased in the past twelve months.

	Total	Meat products	Bakery products	Dairy products	Flavors/food ingreds.	Canned fruit/veg/entrees	Fats and oils	Frozen fruit/veg/entrees	Confectionery products	Cereal/grain products	Beverages
Aseptic packaging equipment	18.2%	23.5%	24.6%	31.6%	20.0%	33.9%	22.2%	27.8%	22.7%	22.8%	32.8%
Bag-in-box	23.9	20.6	33.3	34.2	26.2	32.2	24.4	30.6	34.1	38.6	35.9
Blow molding equipment (incl. blow mold/fill/seal)	5.3	5.9	5.3	5.1	3.1	8.5	6.7	8.3	4.5	8.8	4.7
Cartoners	42.5	54.4	54.4	53.2	43.1	49.2	46.7	51.1	59.1	64.9	43.8
Casers	42.9	44.1	43.9	55.7	36.9	49.2	46.7	41.7	38.6	59.6	45.3
Closure handling, application	23.1	26.5	26.3	22.8	26.2	23.7	24.4	25.0	25.0	31.6	28.1
Filling equipment (liquids)	38.5	32.4	38.6	48.1	40.0	49.2	48.9	58.3	40.9	42.1	46.9
Filling equipment (dry products)	28.7	27.9	29.8	31.6	38.5	32.2	31.1	38.9	36.4	49.1	29.7
Filling controls	30.4	30.9	28.1	30.4	44.6	42.4	40.0	41.7	27.3	43.9	37.5
Gas flush systems	21.1	33.8	15.8	25.3	21.5	18.6	20.0	25.0	22.7	15.8	18.8
Vertical form/fill/seal	17.8	20.6	22.8	16.5	18.5	16.9	17.3	19.4	27.3	40.4	14.1
Horizontal form/fill/seal	19.8	29.4	26.3	25.3	21.5	25.4	22.2	33.3	22.7	28.1	20.3
Inspection/detection devices	31.6	45.6	28.1	31.6	33.8	40.7	40.0	44.4	22.7	40.4	40.6
Labelers	47.0	50.0	57.9	55.7	49.2	50.8	57.8	50.0	50.0	49.1	48.4
Markers, coders, imprinters	52.6	55.9	50.9	55.7	50.8	61.0	60.0	58.3	52.3	49.1	57.8
Shrink wrappers (non-palletizing)	23.5	22.1	36.8	25.3	24.6	25.4	17.8	25.0	27.3	26.3	31.3
Shrink wrappers (palletizing)	15.8	13.2	8.8	15.2	18.5	20.3	11.1	16.7	15.9	22.8	17.2
Stretch wrappers (non-palletizing)	15.4	14.7	10.5	12.7	13.8	16.9	13.3	16.7	9.1	22.8	7.8
Stretch wrappers (palletizing)	18.6	16.2	10.5	20.3	15.4	18.6	20.0	22.2	11.4	22.8	18.8
Thermoform/fill/seal	7.7	10.3	7.0	7.8	6.2	15.3	8.9	11.1	6.8	10.5	10.9
Tray formers	10.1	13.2	12.3	6.3	9.2	13.6	4.4	22.2	2.3	8.8	14.1
Weighers	38.5	42.6	47.4	36.7	49.2	35.6	40.0	58.3	40.9	50.9	39.1

Note: Total numbers shown may be more/less than 100% due to multiple answers or no response.

Source: Food Engineering Executive Advisory Panel

PACKAGING BUYERS SURVEY

Important packaging areas

Respondents were asked to check the areas of food packaging likely to be of most importance to their firms over the next two years.

	Percent
Aseptic packaging of high-acid products	24.7
Aseptic packaging of low-acid products, including particulate foods	33.7
Dual-ovenable packaging	30.3
Controlled/modified atmosphere packaging (other than vacuum)	37.8
Vacuum packaging	29.6
Packaging with barrier plastics	59.2
High barrier films	41.2
Tamper-evident packaging	18.4
Thermofforming	20.2
Extended shelf life packaging for refrigerated products	34.8
Retortable plastic packages	20.6
Metal containers	20.6
Plastic cans	24.7
Glass packaging	25.8
Improved lidding/adhesives	27.3

Note: Total of numbers shown may be more/less than 100% due to multiple answers or no response.

Source: Food Engineering Executive Advisory Panel

Concerns about CAP/MAP

Respondents were asked which statement expresses their greatest concern about CAP/MAP.

	Percent
Higher cost of packaging materials and machinery	33.0
Ability of distribution to maintain proper refrigerated temperature	34.8
Ability of films to protect food under modified atmosphere	27.5
Questions about machinery design, reliability, or size changeover	27.2
Ability of lidding materials to contain modified atmosphere/ provide ease of opening	19.6
Identifying optimal gas mixture for preserving product/maintaining it	34.8

Note: Total of numbers shown may be more/less than 100% due to multiple answers or no response.

Source: Food Engineering Executive Advisory Panel

Building barriers

An example is barrier plastics. For the third year in a row more than 59 percent of the respondents checked barrier plastics as being of great importance to them over the next two years. And indeed, barrier plastics have come a long way in recent years, as technology has yielded better plastics with barrier layers and made them more available at a lower price.

The food industry, however, is demanding more. One respondent is looking for "high barrier plastics for extended (3 year) shelf

life." Another needs "inexpensive, high temperature, high barrier plastic, heat sealable containers." The list goes on to include hot fillable, clear, unbreakable high barrier plastic bottles...at a reasonable price. Each year the list of requirements for barrier packages continues to grow: there must be oxygen barrier; flavor barrier; moisture barrier; light and UV barrier; mechanical properties; thermal properties; and aesthetics.

"High Barrier Films," listed as being of significant importance by more than 47 percent of the respondents, are needed to fill a variety of needs. One respondent was very specific, saying he needs "a formable film that has an outer oxygen barrier that peels off easily and leaves an inner film with oxygen transmission properties but maintains a water vapor barrier. On packaging it should look like a vacuum skin pack, afterwards in a grocery case, a bloomed piece of meat."

Said another respondent: "We need a method to package precooked meats to assure a 90 day refrigerated shelf life without having to reheat inside the final pouch/container for microbial kill. Need a nice appearing package since it will go retail and customer wants good image presentation. Need is for equipment film to do this."

Tamper-evident packaging

More than 60 percent of the survey's respondents checked off tamper-evident packaging as being of major importance. In the past several years, the use of tamper-evident packaging has increased substantially, both in response to processor concerns and in answer to consumer demands.

One processor is looking for a tamper-evident lid for dairy cups. He says: "This seems to be taking a back seat to other tamper-evident containers and advancements. The dairy industry has been pushed off into a corner with tamper-evident bands as the only alternative. Tamper evident banding machines and material are costly, inefficient and not very well designed for high speed filling."

CAP/MAP

No current discussion of packaging could take place without talking about controlled/modified atmosphere packaging, an area of interest to 37.8 percent of the survey respondents. Many of those polled expressed their concerns about CAP/MAP (see chart) and many were very specific in describing their needs:

- A barrier package for CAP wherein a contained system produces an exothermic chemical reaction in response to elevated

PACKAGING BUYERS SURVEY

Inspection equipment in use

Respondents were asked what type of package inspection equipment they currently have.

	Percent
Vision (black/white)	13.8
Vision color	6.9
Infrared	4.3
Gamma ray	7.2
X-ray	5.4
Sonic	10.5
Vacuum	19.2
Mechanical seam	9.8
Other	12.0

Note: Total of numbers shown may be more/less than 100% due to multiple answers or no response.

Source: Food Engineering Executive Advisory Panel

Inspection capabilities

Respondents were asked what their inspection equipment could inspect.

	Percent
Cracks & chips	9.8
Solid contamination	8.0
Liquid contamination	3.3
Sidewall/bottom thickness	5.4
Label position	14.5
Label integrity (tears, etc.)	7.6
Distorted label characters	4.0
Fill height	17.0
Seam/vacuum integrity	24.3
Seal integrity (adhesives)	12.7
Cap fill	9.4
Other	6.2

Note: Total of numbers shown may be more/less than 100% due to multiple answers or no response.

Source: Food Engineering Executive Advisory Panel

Plant-site manufacturing

Respondents were asked to indicate the type of manufacturing done, if their plants do package manufacturing at the plant site.

	Percent
Can manufacturing	29.8
Thermoform from plastic sheet	27.3
Blow molding	16.5
Paperboard blank assembly (primary package)	37.2
Other	13.2

Note: Total of numbers shown may be more/less than 100% due to multiple answers or no response.

Source: Food Engineering Executive Advisory Panel

temperature. The chilling effect would respond to temperature abuse of refrigerated products, and would cease when refrigeration is reattained or when the package is

opened.

- The use of CAP/MAP must take into account dissolved oxygen in particulate, hard-to-fill foods where air incorporation is difficult, or almost impossible in some cases, to control. This, said the respondent, needs more than a "flush" type system.

- Resealable CAP packaging with the ability to reintroduce the atmosphere into the container once it is opened and a portion of the product is removed. This would eliminate the need for individual packing of portions.

- One respondent had what he called his "total blue sky idea." He wants a gas flush package (see through) where the inside environment (gas) turns color when microbiological spoilage occurs.

Spoilage, in fact, has always been a prime concern for processors, now even more so with the growth of fresh, refrigerated foods. The two highest levels of concern with CAP/MAP were distribution's ability to maintain proper refrigerated temperature during shipping and handling (34.8 percent) and being able to identify the optimal gas mixture for preserving and maintaining individual products (34.8 percent).

Fresh, refrigerated market

Looking at the results of the survey, one area that shows considerable potential growth is in the use of time/temperature package monitors for use in supplying shelf life information for fresh, refrigerated foods. A significant 45.2 percent of the respondents indicated they were considering use of time/temperature monitors. When compared against the 4.8 percent who said they are already using the monitors, this reflects intense interest in these devices and a huge area of potential growth within the packaging industry.

And whether they seek longer shelf life packaging for fresh poultry with better barrier characteristics or they want to use an oxygen absorber that enhances extended shelf life, what processors seek is the right package to meet their needs in the competitive arena of the refrigerated supermarket cases.

Such spectacular growth has taken place in this arena that the fight is clearly on for dominance. To get that, you've got to have the right package regardless of how "right" the product may be.

Lids, lidstock, and adhesives

We opened Pandora's box with our question about problems with lidstock and/or ad-

PACKAGING BUYERS SURVEY

Use of heat-sensitive inks

Respondents were asked if they retort products, were they considering using heat-sensitive inks on each package to identify whether the package has been exposed to the proper thermal conditions.

	Total
Already using	20.6%
Already using, but only on retort barrel tags	4.9
Considering use	28.4
Not considering use	46.1

Note: Total of numbers shown may be more/less than 100% due to multiple answers or no response.

Source: Food Engineering Executive Advisory Panel

Refrigerated time/temperature monitor use

Respondents were asked if they produce fresh foods where shelf life information is important, are they considering using the new generation of time/temperature package monitors in their distribution.

	Total
Already using	4.8%
Considering use	45.2
Not considering use	49.2

Note: Total of numbers shown may be more/less than 100% due to multiple answers or no response.

Source: Food Engineering Executive Advisory Panel

Susceptors

Respondents were asked if they currently produce microwaveable foods in trays, are they exploring any of the susceptor and other metal technologies to enhance microwave package performance.

Yes	60.5%
No	39.5%

Note: Total of numbers shown may be more/less than 100% due to multiple answers or no response.

Source: Food Engineering Executive Advisory Panel

Susceptor use — why not?

Respondents were asked why they were not exploring any susceptor or other metal technologies for microwave packages.

	Percent
Too expensive	9.1
Too complicated	6.8
Corporate inertia	13.6
No real advantage for our particular products	68.2

Note: Total of numbers shown may be more/less than 100% due to multiple answers or no response.

Source: Food Engineering Executive Advisory Panel

hesives, and received an onslaught of responses.

What is it the processors are looking for? Seal integrity, with peelability, for one, (a high-security/easy-open system that would stand up to the distribution system, yet that the consumer could easily open); a peel seal that withstands high stress during fabrication; compatibility between lidstock and cupstock; microwaveable, peelable, see-through lidstock for plastic retort containers; lidding materials that maintain their seal integrity until the product is microwaved, then the seal releases giving the consumer easy access.

Yes, all of these things sound reasonable...it's just a matter of accomplishing them.

High Investment in equipment

According to the survey, the industry was certainly not hesitant about investing in equipment. Markers/coders/imprinters, cartoners, tray formers, weighers, labelers and casers were among the most-purchased pieces of equipment in the last year (see chart for individual breakdown).

Here, too, however, there is a wide range of needs which processors are having difficulty filling, including everything from an aseptic system that works well with fruit particulates (current units, say the respondent, are destructive) to a high-speed filling and sealing system with a leak detection system for packaging retortable plastic containers with lids. Another processor wants packaging equipment that is self-adjusting in relation to material being used, and that offers self-corrective timing with the machine itself.

One processor's demand was pretty easy to understand: "[I want] one piece of equipment that doesn't exceed the cost of my house!"

Heightened activity in the offing

A review of the charts accompanying this feature will give each reader an idea of where there was activity, concern, advances, etc. during the past year. What it also points out is that it was another year of heightened activity in an area of the industry that is becoming ever-more complex.

Almost every respondent had a "wish" he wanted fulfilled. Now it is up to the packaging industry to develop the new technologies and extensions of existing technologies to meet the needs of this rapidly changing marketplace.